

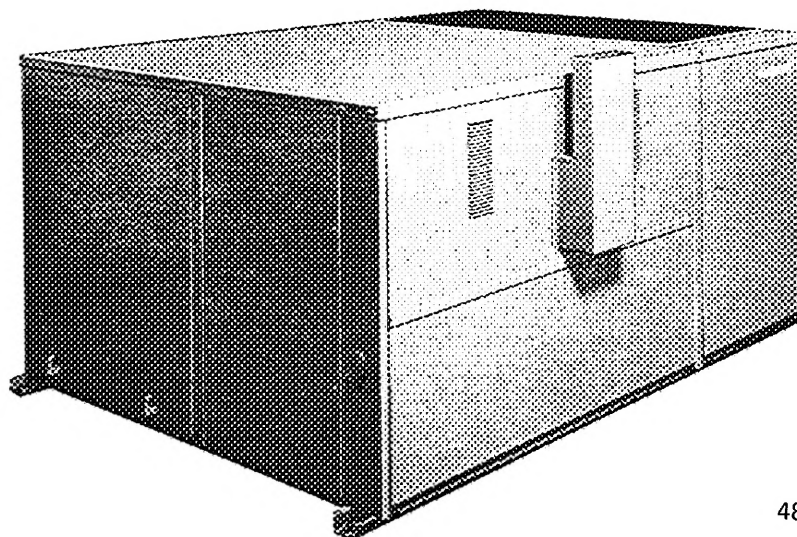


*Superseded by
48DD-2P 6/70*

Combination Heating/ Cooling Units

48DD

Gas Heating 275,000 Btuh
Electric Cooling 124,000 Btuh



48DD012

DESCRIPTION

The 48DD012 is a one-piece combination gas heating/electric cooling unit designed primarily for outdoor rooftop installation on a factory-supplied curb accessory but can be installed on grade or conventional steel framework. This unit combines superior performance with compactness, versatility of application and ease of installation to supply year-round air conditioning for commercial and industrial

buildings. The unit is completely factory assembled, charged and tested. Requires only natural gas, and suitable electrical and duct connections for hookup. Air can be supplied to the building either thru bottom of the unit or thru the side. A manually-adjustable outdoor air intake is provided. Condensers are air cooled. Low silhouette design allows units to be easily hidden from street level view.

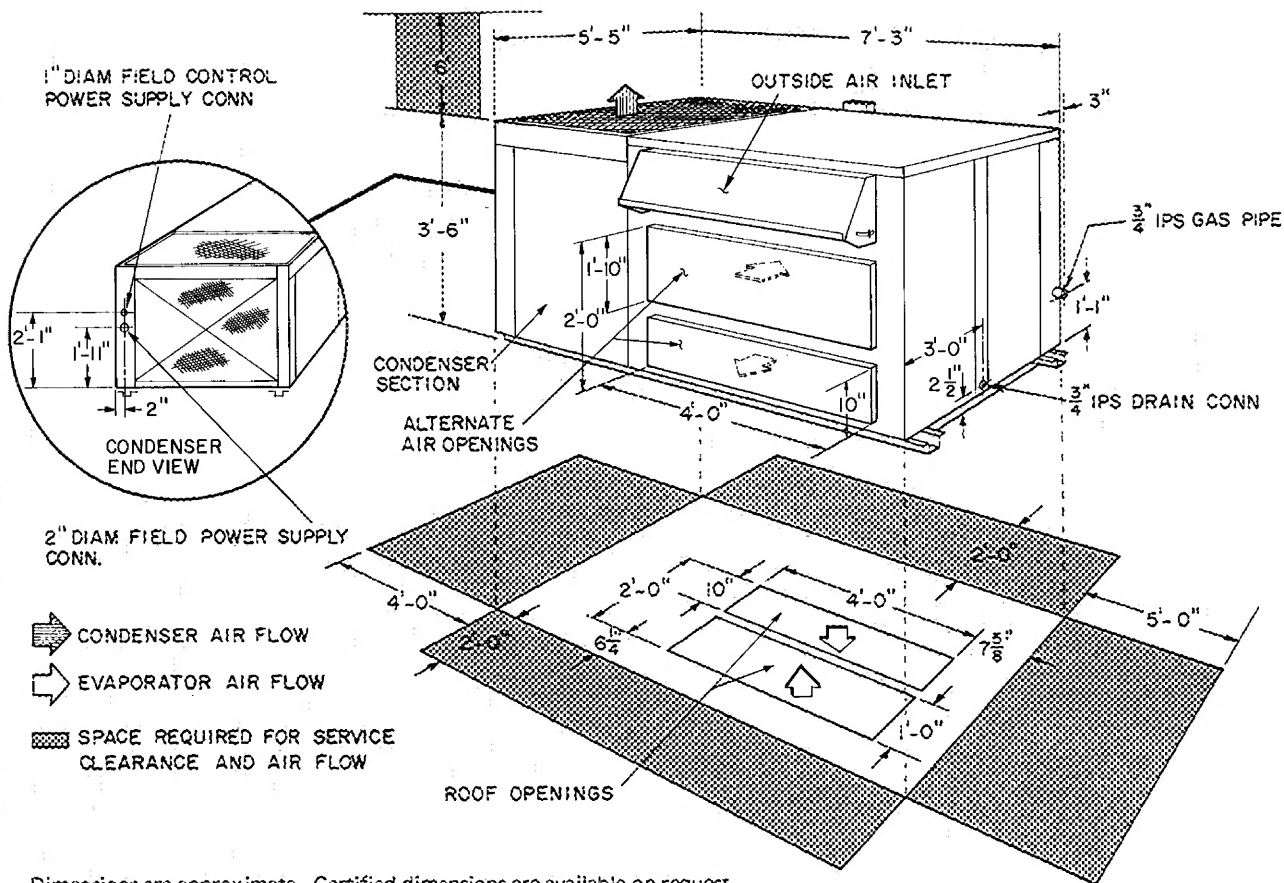
FEATURES

- **Two-Stage Heating and Cooling** — Both heating and cooling stages have 50 percent or 100 percent capacity ranges of operation. This reduces operating costs.
- **Multiple Choice of Air Flow** — Air can be delivered to the building either thru the bottom of the unit with separate inlet and outlet air ducts or concentric ducting, or it can be delivered thru the side of the unit with separate inlet and outlet air ducts.
- **Gas Safety Control** will shut off the main gas valve in case of pilot or combustion air failure, or overheating of the heat exchangers.
- **Induced Draft Combustion** — Unaffected by winds and drafts. Equipped with safety shut-off devices in case of combustion air failure or blockage.
- **Automatic Electric Ignition** — Pilot flame is automatically relighted in case of interruption of power or gas.
- **Aluminized Heat Exchangers** — Resist corrosion and provide long, quiet, safe, and efficient operation. These heat exchangers have a full ten-year warranty.
- **Time Guard Circuit*** prevents rapid cycling, extends compressor life. When power to unit is interrupted, compressor cannot restart for five minutes.
- **Head Pressure Control** automatically cycles one of two condenser fans, permitting cooling operation down to 35 F ambient temperature.
- **Other Quality Components** — Crankcase heaters and accumulators to protect the compressor against flooded starts, filter-driers and sight glasses for moisture control and visual inspection of refrigerant charge.

ACCESSORIES

- **32LM Motormaster™ Head Pressure Control** modulates speed of condenser fan motor to maintain saturated condensing temperature at low outdoor temperatures.
- **Thermostat Assembly** is a two-step heating/two-step cooling thermostat and a matching switch base. Either automatic or manual changeover is available.
- **Remote Control Center** allows manual control of the unit from a location remote from the thermostat. The thermostat furnished with the remote control center has no knobs or switches for manual control.
- **Roof Curb** frames roof opening, is watertight connection between unit and roof. Designed so ductwork and roof flashing may be installed prior to placing the unit.
- **Modulating Outside Air Control Package (economizer)** can furnish outside air for cooling when outside air temperature is below 60 F. It can replace operation of the refrigerant system under these conditions.
- **LP Conversion Kit** used to convert the unit from natural gas to LP gas usage.
- **Relief Damper** used to relieve positive building pressure.

DIMENSIONS



Dimensions are approximate. Certified dimensions are available on request.

PHYSICAL DATA

UNIT 48DD	012
OPERATING WEIGHT (lb)	1690
REFRIGERANT	22
Operating Charge (lb)	9 each System
COMPRESSOR	(2) Reciprocating Hermetic
Cylinders...Rpm (60-Hz)	4 each 3500
OUTDOOR AIR FANS	Propeller; Direct Drive
No. ...Diam (in.)	2 22
Nom Cfm each...total	3200 .6400
Motor Hp...Rpm	1/2 1140 (3-phase) 1075 (1-phase)
CONDENSER COIL	Plate Fin
Rows...Fins/in.	4 13
Total Face Area (sq ft)	14 0
INDOOR AIR FANS	Centrifugal; Belt Drive
No. ...Size (in.)	2 10 x 10
Nom Cfm	4000
Rpm Range (Standard Drive)	1230 to 1540
Max Allowable Rpm	1700
Belt Type...Length (in.)	A. 44
Motor	
No. ...Hp...Rpm	1 3 1745
Max Brake Hp	3 45
Frame	182T
Shaft Diam (in.)	1 1/8
Pulley Pitch Diam (in.)	5 6
EVAPORATOR COIL	Plate Fin
Total Face Area (sq ft)	10 02
Rows...Fins/in.	3 14
HEAT EXCHANGERS	Aluminized Steel
A.G.A. Certified Rise	45 to 75 F
No. ...Elements (each)	2 .5

SELECTION PROCEDURE (With Example)

I Determine cooling and heating requirements at design conditions.

GIVEN:

Required Cooling Capacity (TC)	128,000 Btuh
Sensible Heat Capacity (SHC)	90,000 Btuh
Required Heating Capacity	198,000 Btuh
Condenser Entering Air Temp	95 F
Indoor Air Temp	80 F Edb, 67 Ewb
Evaporator Air Quantity	4000 Cfm
Electrical Characteristics	230-3-60
External Static Pressure	8 in. wg

II Select unit based on required cooling capacity.

Enter Cooling Capacities table at condenser entering air temperature of 95 F. The 48DD012 at 4000 cfm and 67 F Ewb will provide a total capacity of 132,000 Btuh and a sensible heat of 96,000 Btuh. Calculate SHC correction if required.

III Compare the heating capacity of the unit selected with the design conditions.

Unit 48DD012 provides an input of 275,000 Btuh with a bonnet capacity of 206,000 Btuh.

IV Determine fan speed and brake hp requirements at design conditions.

Enter Fan Performance table. At 4000 cfm and 8 in. wg, the fan speed is 1405 rpm and brake hp is 2.34. The table indicates that standard drive is adequate.

V Select unit that corresponds to available power source.

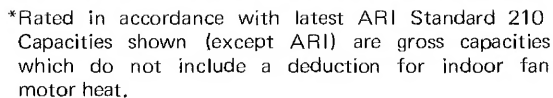
Refer to Electrical Data table and choose unit as required. A 48DD012 230-3-60 is available.

PERFORMANCE DATA

COOLING CAPACITIES (60-Hz)

48DD012 ARI* - 124,000 BTUH

Temp (F) Air Ent Cond		Evap Air – Cfm/BF								
		3000/.08			4000/.10			5000/.12		
		Evap Air – Ewb (F)								
		72	67	62	72	67	62	72	67	62
85	TC	147.1	134.8	122.5	149.4	139.4	129.5	153.0	144.1	131.0
	SHC	73.0	87.5	103.5	78.8	99.6	120.2	87.7	111.5	131.0
	KW	14.4	14.0	13.4	14.7	14.2	13.9	14.7	14.6	14.2
95	TC	138.9	128.1	117.4	141.6	132.2	123.8	146.2	136.8	128.6
	SHC	68.7	84.9	101.4	76.3	96.4	117.6	83.4	108.2	128.6
	KW	15.6	14.9	14.2	15.9	15.2	14.6	16.3	15.6	15.0
100	TC	134.0	124.8	114.8	137.6	128.2	117.3	142.6	133.4	125.1
	SHC	67.3	84.0	99.6	73.7	94.9	114.8	82.2	107.0	125.1
	KW	16.1	15.3	14.6	16.3	15.7	15.5	16.5	16.0	15.4
105	TC	130.4	120.7	111.5	133.1	123.8	114.8	147.2	128.9	121.7
	SHC	65.3	81.6	98.2	71.8	92.9	89.7	79.9	105.0	121.3
	KW	16.7	15.8	15.0	16.9	16.1	16.9	17.1	16.6	15.9
115	TC	121.0	112.1	104.1	123.6	114.8	109.1	126.9	117.0	114.0
	SHC	61.6	78.4	96.8	68.3	89.7	109.1	75.9	101.5	114.0
	KW	17.6	16.6	15.6	17.7	16.9	16.2	18.3	17.3	16.8



BF – Bypass Factor
E_{wb} – Entering Wet-Bulb
KW – Compressor Motor Power Input
SHC – Sensible Heat Capacity (1000 Btuh)
TC – Total Capacity (1000 Btuh)

NOTES:

1. Direct interpolation is permissible Do not extrapolate
2. The following formulas may be used:

$$t_{ldb} = t_{edb} - \frac{\text{sensible capacity (Btuh)}}{1.08 \times \text{cfm}}$$

t_{lwb} = Wet-bulb temperature corresponding to enthalpy of air leaving evaporator coil (h_{lwb})

$$h_{lwb} = h_{ewb} - \frac{\text{total capacity (Btuh)}}{4.5 \times \text{cfm}}$$

Where

$$h_{ewb} = \text{Enthalpy of air entering evaporator coil}$$

3. SHC is based on 80 F edb temp of air entering evaporator coil
Below 80 F edb, subtract (corr factor x cfm) from SHC

		Entering Air Dry-Bulb Temp (F)					
BF		79	78	77	76	75	under 75
		Correction Factor					
.10	97	1 95	2 92	3 89	4 86	use formula shown below	
.20	86	1 73	2 59	3 46	4 32		
.30	76	1 51	2 27	3 03	3 78		

Interpolation is permissible

$$\text{Correction Factor} = 1.08 \times (1 - \text{BF}) \times (\text{edb} - 80)$$

HEATING CAPACITIES

UNIT 48DD012	INPUT (Btuh)	BONNET (Btuh)
First Stage	137,000	103,000
Full	275,000	206,000

NOTES

- 1 Ratings are approved for altitudes to 2,000 ft. At altitudes over 2,000 ft, ratings are 4 percent less for each 1,000 ft above sea level.
- 2 At altitudes up to 2,000 ft, the following formula may be used to calculate air temp rise:

$$\Delta t = \frac{\text{bonnet capacity}}{1.08 \times \text{air quantity}}$$

- 3 At altitudes above 2,000 ft, the following formula may be used:

$$\Delta t = \frac{\text{bonnet capacity}}{(24 \times \text{specific weight of air} \times 60) (\text{air quantity})}$$

- 4 Maximum allowable gas pressure is 140 in wg Minimum allowable gas pressure for full rated input is 50 in wg

- 5 Unit may be field converted for 100 percent LP gas, using Carrier factory parts Units will maintain A.G.A. certification if conversion is performed as directed and conversion nameplate is attached to unit adjacent to existing unit nameplate

FAN PERFORMANCE, 48DD012

CFM	EXTERNAL STATIC PRESSURE (in. wg)																
	.1	.2	.3	.4	.5	.6	.7	.8	.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7
	Fan Rpm																
3000	-	-	-	1010	1080	1140	1205	1270	1330	1395	1435	1480	1525	1570	1615	1660	1700
3400	-	-	1020	1080	1140	1210	1265	1325	1380	1430	1475	1520	1560	1605	1650	1695	-
3800	970	1030	1095	1155	1215	1270	1320	1380	1425	1470	1515	1560	1605	1650	1695	-	-
4000	1010	1075	1135	1195	1245	1300	1355	1405	1450	1495	1540	1590	1635	1680	-	-	-
4200	1055	1115	1175	1230	1275	1330	1385	1430	1480	1520	1565	1610	1655	1700	-	-	-
4600	1145	1200	1245	1290	1345	1400	1445	1485	1530	1575	1620	1665	-	-	-	-	-
5000	1230	1270	1315	1370	1420	1465	1510	1550	1595	1640	1685	-	-	-	-	-	-

Motor brake horsepower

NOTES:

- 1 Fan performance has deductions for unit casing losses, wet coil, heat exchanger, and clean filters

2. Fan motor bhp is based on minimum voltage and 80 F air across the standard motor
3. All table values printed in *italics* indicate non standard conditions

ELECTRICAL DATA

OPERATING SEQUENCE

Cooling — Power on and thermostat assembly set at "Cool," "Fan Auto" and desired temperature.

Step 1 of cooling thermostat energizes outdoor and indoor fans and Time Guard Circuit. Time Guard Circuit delays the start of the compressor for fifteen seconds.

Step 2 of cooling thermostat operates a second Time Guard Circuit which delays the start of the second compressor for fifteen seconds. On compressor shutdown for any reason, Time Guard Circuit prevents compressor restart for at least five minutes.

Capacity Control — Two-step thermostat operates the compressors as the cooling load changes.

Heating — Turn power and gas on, and set thermostat assembly at "Heat," "Fan Auto" and desired temperature.

The induced draft motor is energized whenever unit field power is on with thermostat set for "Heat" or "Auto." No. 1 glow coil ignites the no. 1 pilot (a thirty-second delay occurs before glow coil lights the pilot). Electric pilot shifts to no. 2 glow coil and no. 2 pilot ignites.

After all pilots ignite, unit is ready to heat. When step 1 of heating thermostat closes; the gas valve relay energizes, the main gas valve opens, the indoor fan relay (IFR 2) closes, the indoor fan contactor energizes, and the indoor fan motor starts. Burners are now at 50 percent capacity.

When step 2 of heating thermostat closes and energizes the second stage of gas valve, the unit operates at full capacity.

When call for heat is satisfied, step 2 of thermostat opens, de-energizing the second stage of the gas valve.

Unit may cycle between 50 percent and full capacity as step 2 dictates. When step 1 of the thermostat opens, the gas valve relay shuts off the main gas valve and indoor fan motor.

Automatic Changeover — When system selector switch is set at "Auto," unit will automatically change from heating to cooling when the temperature of the conditioned space rises to the cooling lever setting. When the temperature of the conditioned space falls to the heating lever setting, the unit will automatically change from cooling to heating.

The thermostat and unit are so connected that the cooling and heating systems will not operate simultaneously.

Air Circulation — With power on and unit controls set at "Off" and "Fan," indoor air fan operates continuously for air circulation. When controls are set at "Heat" or "Cool" and "Fan," heating or cooling is provided as required, while indoor fan motor operates continuously.

OPERATING SEQUENCE — ACCESSORY MODULATING OUTSIDE AIR CONTROL

Cooling Season — Thermostat assembly set at "Cool" and "Fan Auto." Damper goes to "Vent" when step 1 of cooling thermostat closes, energizing outdoor and indoor fan motors and the compressors.

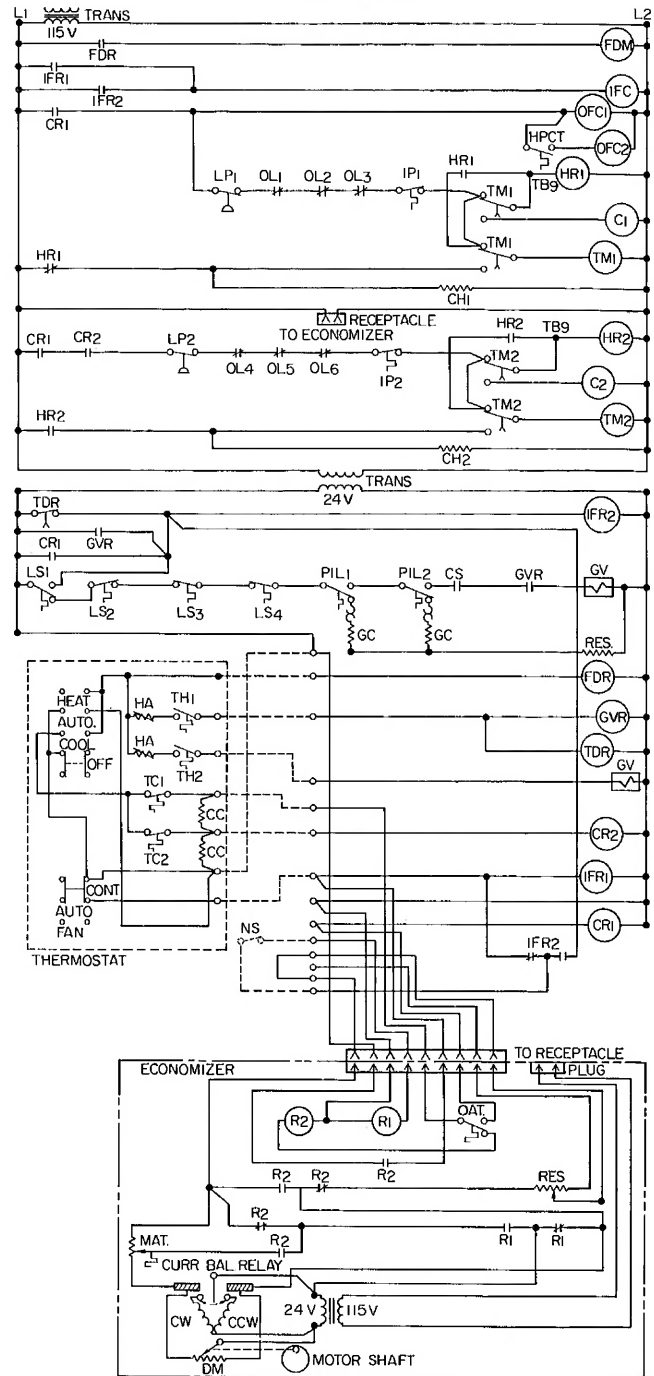
When step 1 is satisfied, outdoor and indoor fan motors and the compressor shut off, and the outside air damper closes. (Damper always stays at "Vent" during cooling sequence if fan switch is at "Fan," and night switch is closed.)

Intermediate Season — Same as for cooling season, except that as step 1 of thermostat closes and indoor fan motor starts, compressor and outdoor fan motor remain off if outside air temperature is below outdoor air thermostat setting. If outside and return air temperature rises above or drops below mixed air thermostat setting, the outside air damper will reposition to maintain the thermostat setting. Damper will move to closed position when cooling step 1 is satisfied. Damper will move to "Vent" position when fan switch is at "Fan."

The outside air damper will close when the night switch is opened (night position), or whenever the indoor fan shuts down.

Heating Season — Damper always stays at "Vent" while fan motor is operating. Outside air damper closes when night switch opens.

TYPICAL WIRING



LEGEND

C — Compressor Contactor	LP — Low Pressure Switch
CC — Cooling Compensators	LS — Limit Switch
Ccw — Counterclockwise	MAT. — Mixed Air Thermostat
CH — Crankcase Heater	NS — Night Switch
CR — Control Relay	(Field supplied)
CS — Centrifugal Switch	OAT. — Outside Air Thermostat
Cw — Clockwise	OFC — Outdoor Fan Contactor
DM — Damper Motor	OI — Overload
FDM — Forced Draft Motor	Pil — Pilot
FDR — Forced Draft Relay	R — Relay
GC — Glow Coil	RES — Resistance Wire
GV — Gas Valve	TB — Terminal Block
GVR — Gas Valve Relay	TC — Thermostat, Cooling
HA — Heating Anticipator	TDR — Time Delay Relay
HPCT — Head Pressure	TH — Thermostat, Heating
— Control Thermostat	TM — Timer Motor
HR — Holding Relay	TRANS — Transformer
IFC — Indoor Fan Contactor	
IFR — Indoor Fan Relay	——— Factory Wiring
IP — Internal Protector	----- Field Wiring

ELECTRICAL DATA (Cont)

ELECTRICAL DATA (60-Hz)

V/PH	VOLTAGE RANGE	UNIT			COMPR*		IFM	OFM
		WSA	ICF	FU	FLA	LRA	FLA (ea)	
208/3	220-180	79.6	152	100	27.60	110	10.6	3.2
230/3	254-198	70.0	137	90	23.80	100	9.2	3.2
460/3	506-414	33.9	69	45	11.85	50	4.6	1.2

FLA — Full Load Amps

FU — Fuse (max allowable amps)

ICF — Max Instantaneous Current Flow during start-up is the sum of compressor LRA plus the FLA of all other motors in the unit

IFM — Indoor Fan Motor

LRA — Locked Rotor Amps

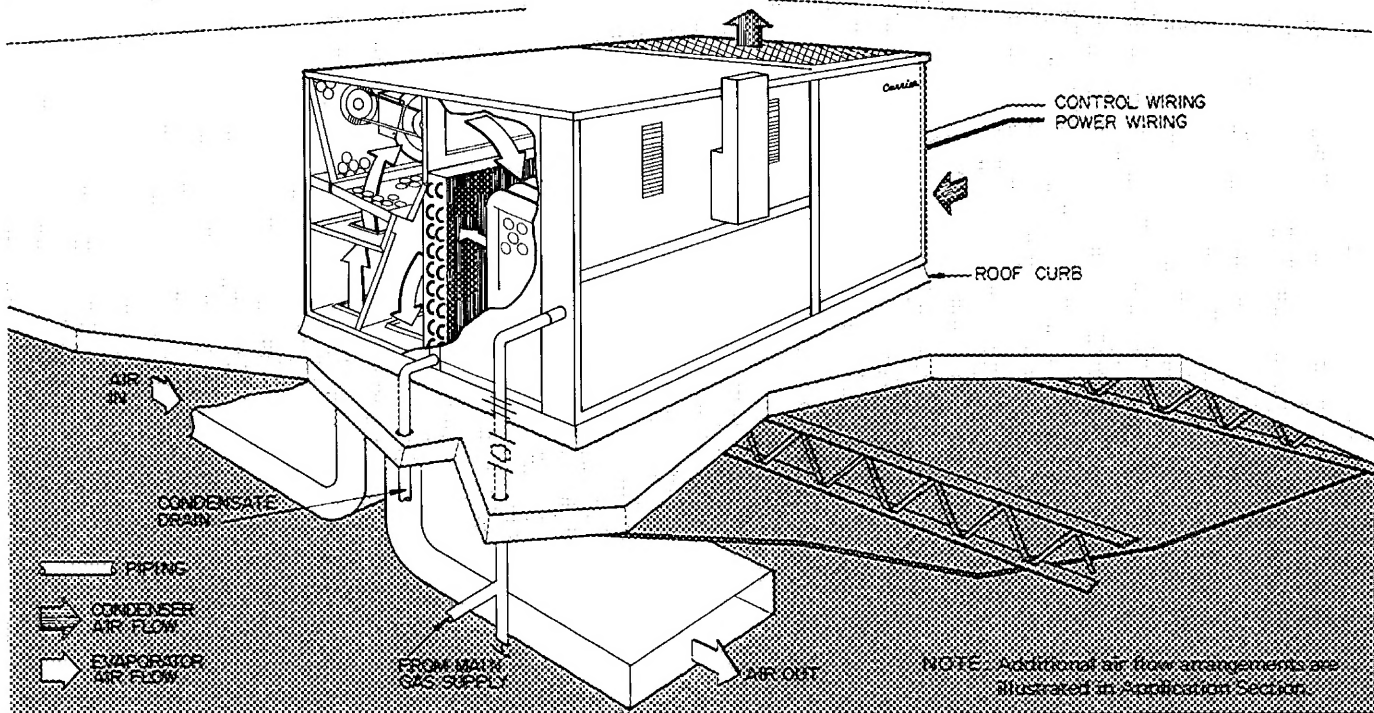
OFM — Outdoor Fan Motor

WSA — Wire Sizing Amps per NEC equals 1.25 x FLA of the largest motor plus the sum of the FLA of all other motors in the unit.

*Unit has two compressor motors; values are for each.

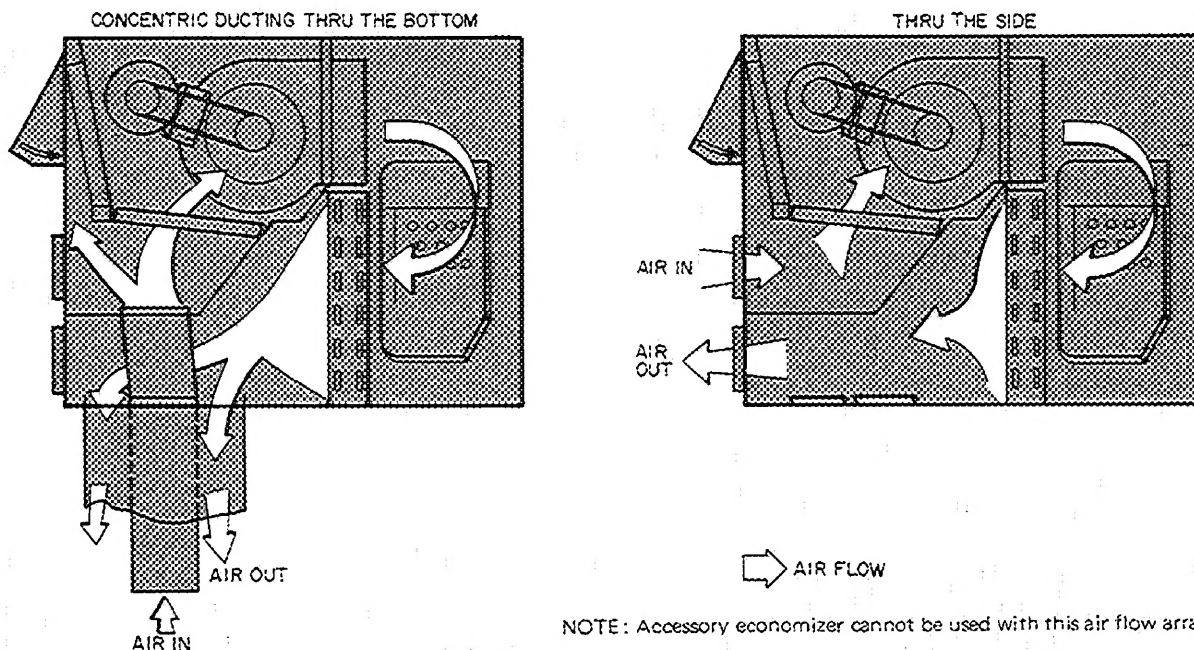
TYPICAL PIPING AND WIRING

ROOFTOP INSTALLATION WITH SEPARATE SUPPLY AND RETURN DUCTWORK



APPLICATION

ADDITIONAL UNIT AIR FLOW ARRANGEMENTS



APPLICATION (Cont)

LOW OUTDOOR TEMPERATURE COOLING OPERATION

It is not necessary to use the refrigeration system for cooling when the outdoor air temperature is below 60 F. The use of outdoor air will handle the cooling load. This is a more economical method of cooling in cold weather.

One condenser fan motor is cycled off when the outdoor air temp drops to 55 F. This allows operation down to 35 F outdoor

temperature. The other condenser fan motor is suitable for use with the 32LM Motormaster™ Head Pressure Control at outdoor temperatures below 35 F (see Accessories). Operation with this control requires winter start provisions (low pressure switch recalibration); and may require field-fabricated condenser air baffles.

CONTROLS (Protective Devices)

- **Limit Switches** shut off gas supply if excessive air temperatures should develop; limit discharge air temperature to 175 F when unit is used for heating.
- **Current Overloads with Automatic Reset** are current sensitive and temperature compensated; will open the control circuit if compressor current is excessive.
- **Internal Thermostat with Automatic Reset** is embedded in compressor windings; de-energizes the control circuit if extreme temperatures should develop due to excessive suction gas temperature or motor overloading.
- **High Pressure Relief Device** protects unit from excessive compressor discharge pressures and prevents overheating.

- **Circuit Breaker** provides short circuit protection for controls.
- **Low Pressurestat with Automatic Reset** de-energizes the control circuit if refrigerant pressure drops below setting; provides protection from loss of refrigerant charge.
- **Inherent Fan Motor Protection with Automatic Reset** opens power circuit if temperatures or current become excessive on 3-phase motors (single-phase motors are temperature sensitive only).
- **Fusible Plug** located on the accumulator, protects against excessive pressures or temperatures in the refrigerant system.
- **Centrifugal Switch** located in the induced air fan motor will de-energize the gas valve in case of combustion air failure.

GUIDE SPECIFICATIONS

Unit shall be of the single-package type, combination air-to-air cooling and gas-fired heating.

Total Net Cooling Capacity of the system shall be 124,000 Btuh or greater, and sensible capacity shall be 94,900 Btuh or greater, at conditions of: 4500 cfm evaporator air entering unit at 67 F wet-bulb, 80 F dry-bulb and condenser entering air temperature of 95 F dry-bulb. Compressor power input shall not exceed 15.5 kw.

Heating Capacity of the system shall be 206,000 Btuh or greater, with gas input of 275,000 Btuh.

Casing shall be constructed of galvanized steel, bonderized and coated with baked enamel.

Compressor — The unit shall contain two hermetic compressors with suitable vibration isolators. Crankcase heaters shall be supplied with the unit.

Coils shall be constructed with aluminum plate fins mechanically bonded to copper tubes.

Fans and Motors — The indoor fan shall be of the forward-curved centrifugal type, belt driven by a 3 hp motor. The condenser

section shall have two propeller fans, each directly driven by a 1/2 hp motor.

Heat Exchanger shall be constructed of corrosion resistant aluminized steel. Burners shall be of the Bunsen (aerated) slotted port type; readily accessible, and covered by a 10-year warranty.

Safety Controls — Cooling section shall be protected by: fusible plug, low pressurestat, compressor motor overloads, and a timing device which will prohibit the compressor motor from being subjected to starting current more than once every five minutes.

Heating Controls shall consist of an automatic gas valve, pilot, automatic ignition system, limit switches and a centrifugal switch.

Dimensions — The unit casing shall have width of not more than 65 in., length of not more than 87 in., and height of not more than 42 inches.

Accessories — Roof Curb, Modulating Outdoor Air Control, Remote Control Center, Two-Stage Heat-Cool Automatic Change-over Thermostat, Relief Damper, LP Conversion Kit, and 32LM Motormaster™ Head Pressure Control.

Manufacturer reserves the right to change any product specifications without notice.

CARRIER AIR CONDITIONING COMPANY • SYRACUSE, NEW YORK